Sept. 4, 1945. T. A. ST CLAIR 2,384,266

GAS DISPENSING SYSTEM

Filed April 6, 1942 2 Sheets-Sheet 1

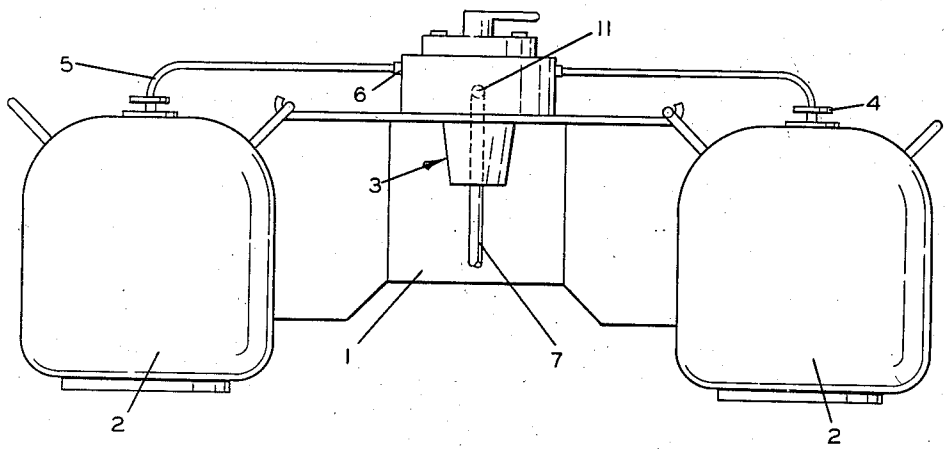


FIG. 1

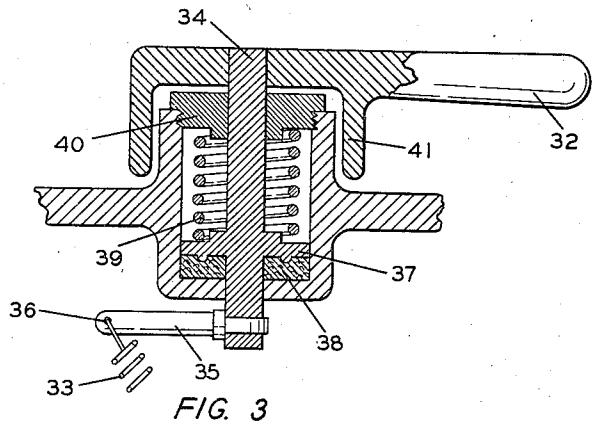


FIG. 3

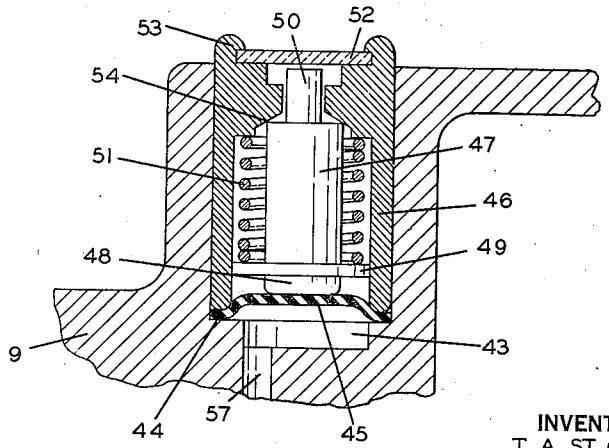


FIG. 4

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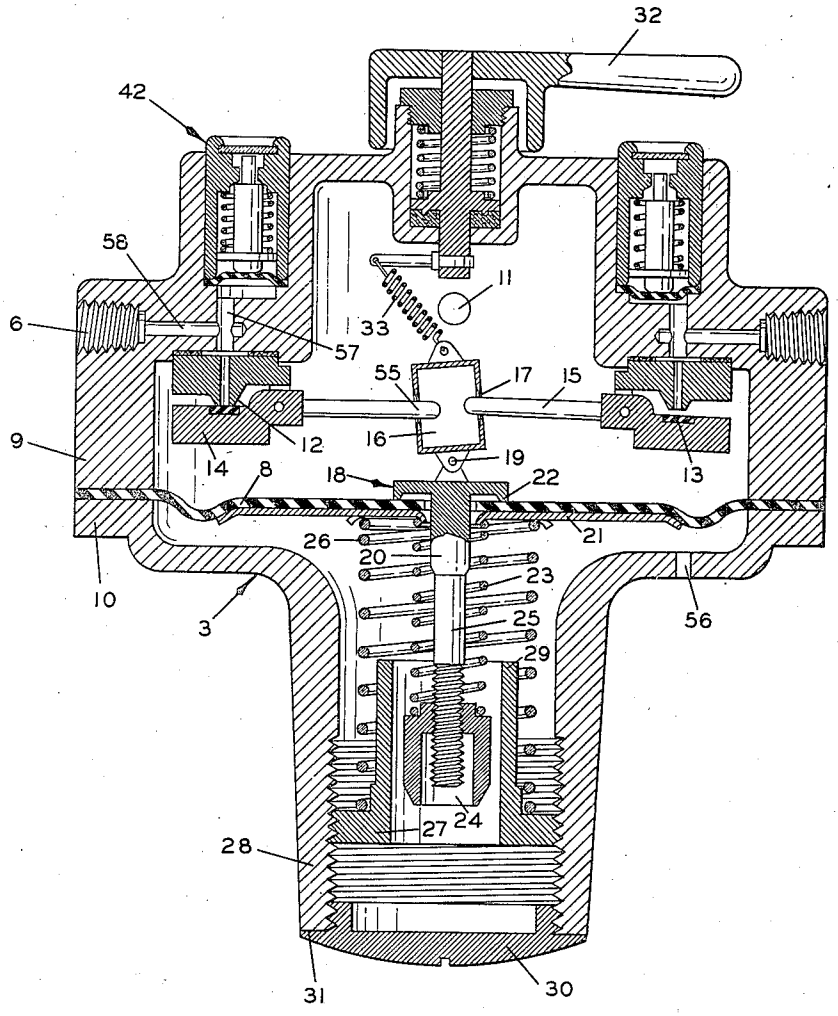


FIG. 2

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GAS DISPENSING SYSTEM

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Application April 6, 1942, Serial No. 437,892

4 Claims. (Cl. 50—10)

My invention is a combined regulator and changeover for a liquefied petroleum gas dispensing system.

More specifically, my invention is an improved changeover and regulator of the selective presetting type, in which only a single diaphragm is required for the pressure regulation, relief valve and changeover functions of the device. All of the above-cited functions are carried out within a single appliance which, in addition, has incorporated therein a novel arrangement for indicating the status of the supply sources. My present invention is particularly adapted for use in a self-service system such as has been widely popularized by my assignee in the past five or six years.

The method of marketing referred to above involves, briefly, the installation of a pair of small portable cylinders of propane or other liquefied gas with suitable means to support the cylinders and one or more regulators connected to a service line. Upon exhaustion of the first cylinder of gas, the user disconnects the same and exchanges it for a filled cylinder at his convenience, meanwhile using the content of the second or reserve cylinder.

Two general types of system are used in this method of distributing fuel gas. The so-called "Standard" type of system utilizes a simple pressure regulator which may be attached first to one cylinder, then the alternate one. This system has an obvious disadvantage in that the user must go outside and change cylinders to re-establish service each time a tank becomes empty. This involves checking all appliances to be sure the burners are shut off before connecting the reserve tank, and also relighting of pilot lights on the gas range, water heater, refrigerator, or any other appliance so equipped.

The second general type of system employed in the business provides for automatic changeover of withdrawal from an exhausted "Supply" cylinder to the alternate or "Reserve" cylinder. Some pressure-responsive indicating means are provided to apprise the user of the changeover so that he will be warned of the condition of the system and will then replace the empty tank before the "Reserve" tank is exhausted. In this manner, continuous operation is had and the user is spared the task of relighting pilots, and is also spared the inconvenience of having service interrupted during the preparation of a meal, for example.

Heretofore, devices for providing the automatic type of service above described have employed either two adjustable differentially loaded first stage regulators and a second stage regulator downstream from both, or have employed a pair of first stage regulators of equal outlet pressure with a separate and independent changeover device to provide selective withdrawal. In the latter case, a second stage regulator is also often employed. In any event, the resulting assembled system usually employs at least three and often as high as five or six diaphragms having their outward sides exposed to the atmosphere and their inner sides subjected to a superatmospheric pressure. This latter pressure at all times is at least the operating pressure of the system, and in case of a leaking regulator valve the diaphragms may be exposed to the full tank pressure, which is often as much as 200 to 300 pounds per square inch. Each of the several diaphragms, then, is a vulnerable point in the system and a potential source of service trouble if not indeed a hazard.

Past devices have also had a common fault in that the indicators used have simply indicated the exhaustion of one of the tanks without directly identifying which of the two tanks had been exhausted. Thus some auxiliary means of identifying the cylinder status was required. Quite often the identification was based on a rather involved process of mental deduction on the part of the user or operator.

My invention then represents an improvement which is manifested in several ways. First, my improved changeover regulator uses but a single diaphragm for all the pressure control functions, which include regulation, changeover and pressure relief on the low pressure side of the regulator valves. While my device does employ two additional diaphragms for indicator service, these diaphragms are extremely small, are flexed only infrequently, may be made of heavy material because they need not be sensitive to small pressure changes, and are furthermore completely closed off and protected on their outward sides. Thus, the indicator diaphragms are practically indestructible by any pressure that they would conceivably be required to resist, and because of being of being totally enclosed, their failure would be of no consequence in regard to safety.

The simplicity of my structure also has real utility with regard to cost. A saving is to be realized not only in the cost and number of the parts themselves, but also in the matter of assembly. At the same time, compactness of the operating system is achieved.

The practice of my invention will accomplish many obvious objects, some of which are:

1. To provide a gas system which is simple of operation, both as regards the structure itself and also with regard to the attention required on the part of the user.

2. To provide an automatic gas system which is simple and inexpensive from the standpoint of manufacturing.

3. To provide a gas system of the character referred to in which durability and freedom from operating failures will serve to the advantage of

both the user and the distributor of the equipment.

4. To simultaneously attain the utmost in economy, reliability and safety in an automatic gas system by accomplishing in one single diaphragm the several functions which have heretofore entailed the use of many diaphragms and supplementary assemblies.

Other more specific objects and advantages are illustrated in the remainder of this specification.

In the drawings,

Figure 1 illustrates my invention as it relates to the complete gas system installation. Figure 2 is a frontal view of my device, in section. Figure 3 is an enlarged fragmentary view showing details of the selector lever, and Figure 4 is an enlarged detail in section of one of the indicators.

In Figure 1, a bracket 1 is applied to the outside wall of the user's residence and provides a support for portable gas cylinders 2. My changeover regulator, indicated generally by the humeral 3, is permanently attached to the bracket. Gas is withdrawn from the cylinders through connectors 4 and flexible hoses 5, which communicate with the changeover through inlets 6. The gas, after pressure induction in the regulator 3, is delivered to a service line 7 for transportation to the point of utilization.

In Figure 2, details of my improved equipment are illustrated. A diaphragm 8 is securely gripped between the upper and lower portions, 9 and 10, respectively, which together make up the body of my device. The upper portion contains the two inlets 6 and an outlet 11. This outlet may be located at any convenient place above the diaphragm in the member 9.

In communication with each inlet is a nozzle 12 and a resilient valve seat disc 13, the latter being incorporated in a pivoted rocker 14. Extending from each of the rocker arms is a rigid rocker extension pin 15. A yoke-piece 16 has knife-edged openings 17 which are adapted to receive the free ends of the pins 15. The lower side of the yoke-piece is pivotally attached to the valve member 18 at a point 19 which is common to the vertical axes of both elements. As will be demonstrated later, the member 18 moves in unison with the diaphragm 8 under all normal operating pressures, and therefore, it is seen that both of the valve rockers 14 are operatively connected to the diaphragm 8.

The valve member 18 is formed with a guide portion 20 which passes through a central aperture in the diaphragm 8 and also in diaphragm plate 21. The annular flange or lip portion 22 is adapted to form a sealing contact with the upper surface of the diaphragm, thereby sealing the aperture therethrough. The sealing contact is maintained by pressure of the spring 23, the upper end of which bears against the diaphragm plate 21, and the lower end of which bears against the adjustable collar 24 which is threaded on the extended valve stem 25. In this fashion, the diaphragm, the diaphragm aperture, and the valve member 18 are organized to serve as a low pressure relief valve.

A coil spring 26 is located concentrically about the relief valve structure, bearing at one end upon the diaphragm plate 21, and at the other upon an adjusting ring or collar 27. The collar 27 is threaded into the boss 28 and includes an extended tubular portion or skirt 29. This skirt serves to limit the degree of misalignment of the members 24, 25, etc., with respect to the axes of the whole changeover assembly. Misalignment might otherwise occur because of unequal distribution of diaphragm slack, for example, and would result in disturbance of the regulator or relief valve. A seal cap 30 threads into the boss 28 to a depth which is limited by the shoulder 31 around the periphery of the cap.

By means of a hand lever 32, a spring 33 is tensioned so as to misalign the yoke 16 and thus withdrawal from either side of the gas system may be made preferential. Referring to Figure 3, the hand lever is soldered, keyed or otherwise made secure to a shaft 34, which in turn is fitted with a lever or crank-piece 35. The hand lever, shaft and crank piece are all rigidly secured one to another so that the member 35 will always bear a fixed angular relationship with respect to member 32, as shown in Figure 2. The spring 33 is engaged in an eyelet 36 at the outer extremity of member 35 and similarly is attached to the yoke 16. A collar 37 is formed on the shaft 34, its under side being held against the packing material 38 by virtue of loading imposed on its upper side from a compression spring 39 and a threaded retainer bushing 40. A circular skirt 41 is formed on the hand lever so as to protect the shaft and bushing from dirt, rain, snow, etc.

Referring again to Figure 2, it is seen that each of the inlets 6 are in communication with a nozzle 12 and also with an indicator 42 by virtue of the channels 57 and 58. Figure 4 illustrates the details of the indicator elements, in which the upper end of channel 57 is seen to terminate in a bored recess 43 formed in the upper portion 9 of the regulator body. Upward from the recess is a counterboard portion whose junction with the bore 43 forms a ledge 44 upon which a resilient diaphragm 45 is supported. An inserted member 46 is pressed into place against the upper peripheral edge of the diaphragm, holding same tightly in place and effectively sealing the chamber under the diaphragm against leakage to the atmosphere. The member 46 could of course be threaded into place, if desired.

Fitted movably within the interior of the inserted member 46 is a plunger 47, having a relatively broad base 48 in contact with diaphragm 45, an annular flange portion 49 and a reduced section 50 at the top. As may be readily seen in the drawings, these parts are so organized that the plunger 47 is free to move upward in response to a pressure below the diaphragm, against the loading of a compression spring 51. A transparent window 52 is secured to the top of the insert member 46 by a flanging or spinning operation performed on the metal, forming a retaining flange 53. The window is preferably made from a plastic material having some resilience so that a seal will be formed by the flanging operation without danger of breaking the window. Glass could be used if proper resilient gaskets were provided to separate the glass from the metal surfaces. The length of the reduced section 50, in any event, should be such that its top surface will not contact the window when the plunger is raised to the limiting position fixed by contact at 54. The spring 51 is so proportioned that the plunger 47 will assume the elevated position shown in Figure 4 whenever the tank pressure (communicated to the underside of diaphragm 45) exceeds a nominal value, such as 3 or 4 pounds per square inch, for example.

In operation, the device is connected to two tanks of liquefied petroleum gas and to a service line, as in Figure 1. If the control lever 32 is positioned as in the drawings, the yoke 16 (see

Figure 2) will be misaligned so that withdrawal from the righthand side of the system will be favored. The pressure reduction will of course be subject to the control of the diaphragm 8 and the spring 26, the action of the latter being somewhat modified by that of the small bias spring 33.

If it is assumed that the position of the right-hand rocker arm in Figure 2 is the wide open or full capacity position, it may easily be seen that any increase of pressure above the diaphragm 8 will result in a proportional closing of the right-hand inlet valve, thus providing the desired pressure regulation. The left-hand valve will be unaffected, since it is already in the tight-closed position. It is thus apparent that the tip of the left-hand rocker arm pin 15 remains stationary and is, therefore, the effective pivotal center of rotation of the yoke piece 16 during closure of the right-hand valve. At the same time, it is seen that the resultant clockwise rotation of the yoke piece during closure of the right-hand valve will cause an increased tension in the bias spring 33.

Conversely, upon subsequent reduction of pressure above the diaphragm 8 for any reason, the diaphragm will rise due to the reduced load opposing the main regulator spring 26. The bias spring 33 now tends to recover its former contracted position and hence the yoke piece 16 now rotates counter-clockwise about the point 55 (a point of contact respectively between pin 15 and the upper or lower knife edge in the opening 17). Thus opening of the right-hand valve is accomplished in response to the change of outlet pressure and the left-hand valve remains closed.

From the foregoing, it is evident that withdrawal of gas will continue at all times from the favored or "Supply" side of the system so long as the demand load does not exceed the capacity of the "Supply" inlet orifice or nozzle 12. If the capacity of this side is overtaxed, the remaining or "Reserve" side will be opened sufficiently to help carry the excessive demand load.

Upon exhaustion of the first used (in this case right-hand) cylinder, the withdrawal of gas proceeds without interruption from the "Reserve" side. The regulator will now supply gas to the service line at a slightly lower pressure than before, due to the further-extended working length of the spring 26.

When one of the tanks becomes empty, the respective indicator 42 will signify the occurrence by virtue of the lowering of the plunger 47 upon failure of pressure under the diaphragm 45, so that the section 50 will no longer be readily visible through the window 52. As shown in Figure 2, the indicator at the right signifies exhaustion of supply in the right-hand inlet.

By occasional inspection of the indicators, the customer will be advised of the state of the cylinders and will replace the exhausted one at the first opportunity, reversing the position of the handle 32 at the time the replacement is made so that the withdrawal of gas will not revert to the newly attached cylinder until the erstwhile "Reserve" cylinder is depleted.

Should the pressure within the regulator body exceed a predetermined safe limit, as where the regulator valve does not seat properly, the diaphragm will be displaced downward to a point where the rocker arms 14 can move no further, with the result that further pressuring of the diaphragm will unseat it from the valve disc at the lip 22, thus permitting escape of the excessive pressure through the interior of the boss 28 to the vent opening 56 and thence to the atmosphere. The amount of pressure required to open the relief valve in this manner is controlled primarily by the spring 23 and adjustment collar 24.

The relief valve and main regulator valve springs, 24 and 26, respectively, are made accessible for initial setting or readjustment by removal of the cap 30.

The simplicity of operation, construction and maintenance of my improved changeover regulator is self-evident from the above description. The single diaphragm 8 serves all the major functions utilizing a pressure responsive member. The valves at the two inlets serve the dual purpose of pressure regulation and selective control of withdrawal. The structure of my device is adaptable to many variations and the scope of my invention is defined and limited only to the extent set forth in the following claims.

I claim:

1. A valve of the type disclosed comprising a housing closed by a diaphragm to form a pressure chamber, spring means acting on the diaphragm to oppose the pressure in said chamber, a pair of fluid supply nozzles having ports opening into said chamber, a pair of valves for controlling the escape of fluid into said chamber through said ports, a member pivotally connected to said diaphragm and to said valves respectively for moving them to and from said nozzles, and an operator including a spring connection to said member for biasing it to either side of the center of its pivotal connection to the diaphragm, whereby, when one of said valves is seated, the position of the other is controlled by said diaphragm and when, said other valve is in full open position, the position of the said first valve is controlled by said diaphragm.

2. In the combination of claim 1, means connected to said member for venting said pressure chamber through said diaphragm when the pressure exceeds a predetermined value.

3. A combined pressure regulating and switching valve comprising a housing closed by a diaphragm to form a pressure chamber, a single spring acting centrally on the diaphragm to oppose the pressure in said chamber, a pair of fluid supply connections to said chamber, valves for respectively controlling said connections, means interconnecting said valves with each other and said diaphragm for operating them, and means for biasing said last means to preset the valves so that one is closed and the other is controlled by said diaphragm to regulate the pressure in the chamber, said last two means coacting when the valve controlled by the diaphragm is fully opened to place the other valve under the control of said diaphragm.

4. A valve of the type described comprising a housing closed by a diaphragm to form a pressure chamber, spring means acting on the diaphragm to oppose the pressure in the chamber, a pair of fluid supply valves for controlling the supply of pressure fluid into said chamber, means interconnecting said valves with each other and said diaphragm to effect pressure regulating operation of the valves, and manual means for presetting the valves so that one is closed and the other is opened, said interconnecting means causing the other valve to open when the first valve is fully open.

THEODORE A. ST. CLAIR.